

GUIDE TO USING THE MONTANA DEPARTMENT OF AGRICULTURE CROP & ROTATION MODELING SPREADSHEET

Developed by: Chad Lee, Montana Department of Agriculture
February 2010

Disclaimer:

The Montana Department of Agriculture and its staff are not responsible for:

- Decisions made by parties as a result of using of this spreadsheet or the outcome of those decisions,
- errors within the spreadsheet,
- the reasonableness of original estimates and sample rotations contained in the spreadsheet, or
- the outcome of decisions made by parties who use the spreadsheet as a decision tool after making alterations to the spreadsheet.

The Montana Department of Agriculture provides no assurance that the crops listed in the spreadsheets can be successfully grown in all areas of Montana or elsewhere.

The Montana Department of Agriculture made considerable efforts in designing and testing the spreadsheet, and measures were taken to prevent accidental alteration of formulas. Spreadsheet users should adjust the assumptions and rotation information to be applicable to their farm and check for errors before making any decisions. Ultimately, spreadsheet users are responsible for their own decisions. Spreadsheet users should avoid changing formulas, but if it is necessary to change formulas, take extreme caution.

Purpose

The Montana Department of Agriculture created the crop and rotation modeling spreadsheet to serve as a tool for farmers to compare the economics of different crops and rotations. The spreadsheet allows users to design and compare up to eight rotations. The duration of the rotations can be up to 15 years long. For each crop/year, the user selects field operations to be performed. Up to 15 field operations can be entered for each crop/year. Selected field operations are used to calculate fuel and lubrication costs and to determine time/labor requirements for comparison and planning purposes. Spreadsheet users can use this information to consider the impacts of operations on moisture and to consider equipment needs as it pertains to the timing and synchronization of field operations.

An effort was made to develop reasonable estimates for the 2010 crop year (as of February 2010). Many of these estimates came from projections made by North Dakota State University for Northwestern North Dakota. The default yield assumptions for dryland production are based on averages from region-wide average yields for the 2004 – 2008 period in the USDA National Agriculture Statistics Service “North Central Montana Region” (Glacier, Toole, Liberty, Hill, Blaine, Phillips, Pondera, Teton, and Chouteau counties). Default yield assumptions for irrigated production are based on typical or estimated yields for irrigated cropland in southern Teton County (Fairfield area). Users can (*and should*) change these assumptions and estimates to make the spreadsheet calculations applicable to their farm and growing conditions and to reflect their expectations for future years.

General Instructions:

When using the spreadsheet, only modify or enter information in cells with a yellow background in the following worksheets: “Assumptions” and “Rotation 1” through “Rotation 8”.

Information has already been entered in the yellow spreadsheet cells based on crop and input price levels projected for 2010. Many of these estimates came from projections made by North Dakota State University for Northwestern North Dakota. The information entered is derived from a number of sources. This information can (*and should*) be changed to match the production history and conditions of the farm being evaluated. Spreadsheet users should consider whether the default values reflect their expectations for the future.

It is recommended that users work through the spreadsheet in the order of the worksheets.

- The Assumptions Worksheet is a centralized location where assumptions for price, yield, and costs are entered for crops on a per-acre basis.
- The Rotation Worksheets are where the spreadsheet user designs individual rotations.
 - Information can be entered for up to eight rotations.
 - When a crop is selected for a year in the rotation, the spreadsheet uses information from the Assumptions Worksheet to calculate revenue and expenses.
 - The Rotation Worksheets are designed with some flexibility to allow spreadsheet users to add some expenses that may be specific to the farm, crop, or field for each individual year in the rotation. For example, if raising a particular crop requires the farm to rent an implement or hire a custom operator to complete a field operation, the cost can be entered on a \$/acre basis.
 - The Rotation Worksheets also allow spreadsheet users to specify the field operations that will be performed in individual years. The spreadsheet uses this information to calculate the fuel cost and direct labor requirements for field work (hours/acre).
 - The charts in the spreadsheet display and compare the results of calculations made in each Rotation Worksheet.

Yellow Spreadsheet Cells

Information should be entered or changed only in spreadsheet cells with a yellow background. The yellow spreadsheet cells are for variables. The spreadsheet performs calculations in other cells, based on the entries in the yellow cells. Altering cells with a white background will change formulas, which will likely cause calculations to be in error, significantly impacting analysis results.

Many of the spreadsheet cells that contain formulas have a white background and are “locked”. Additionally, some cells and worksheets are hidden to help prevent accidental changes to formulas and to avoid confusing spreadsheet users. If the user finds it necessary to change or unhide cells, the individual sheet must be unlocked using the following menu sequence: Tools – Protection – Unprotect Sheet – password = “password”. To look for hidden cells, look at the row number for gaps, highlight the rows on either side of the gap, right click, and choose Unhide. To look for hidden sheets: Format – Sheets – Unhide – select sheet to unhide.

Drop-down Boxes

Drop-down boxes are used to restrict the entries that can be made in the Rotation Worksheets (Rotation 1 – Rotation 8). Drop-down boxes are also used in the Rotation Worksheets to restrict:

- selection of crops for each year in the rotation
- selection of field operations for each year in the rotation

All drop-down boxes have the option to select a blank entry if no selection is desired; the only way to select a blank entry is by using the drop-down box. If the Rotation Worksheet has information entered into more years than is desired for a rotation, blank entries should be selected for that year's crop and field operations.

Navigating the Spreadsheet:

WORKSHEETS (<i>in order</i>)	EXPLANATION & INSTRUCTIONS
Disclaimer	Liability disclaimer
Assumptions	<p>The majority of adjustable spreadsheet variables are located in the Assumptions Worksheet (yellow spreadsheet cells).</p> <p>Adjustable variables exist for crop, commodity market price, yield, seed cost, herbicide cost, fungicide cost, insecticide cost, crop insurance cost, fertilizer application rate and cost, fuel and lubrication cost, field operation fuel consumption, off-farm commodity trucking cost, irrigation costs, operating interest cost, net present value discount rate, and machinery capacity (for field operation time requirements).</p>
Rotation 1 Rotation 2 Rotation 3 Rotation 4 Rotation 5 Rotation 6 Rotation 7 Rotation 8	<p>These worksheets allow users to design up to eight rotations.</p> <p>In each worksheet:</p> <ul style="list-style-type: none">• Use drop-down boxes to select the crop to be grown each year to establish the sequence of the rotation (up to 15 years in length).<ul style="list-style-type: none">○ Select blank entries for years not under consideration.○ Enter information so that cycle of a rotation is complete. (<i>For example, if the rotation is winter wheat – chem. fallow, the following should be entered: Yr1 – Winter Wheat, Yr2 – Chem Fallow</i>).• Use drop-down boxes to select the field operations to be performed for each year in the rotation (up to 15 operations per crop/year).<ul style="list-style-type: none">○ Select blank entries for years not under consideration.• The yield adjustment factor increases or decreases the yield of a particular year (<i>relative to the yield entered in the Assumptions page for a given crop</i>) to allow spreadsheet users to make adjustments to reflect rotational benefits that may be achieved by incorporating pulse crops or oilseed crops into a rotation. A yield adjustment factor of 100% results in no change, 200% doubles the yield, 50% reduces the yield by half.• Adjustable variables Land Rent, Custom Hire (Contracted Field Operations), Machine Rent, Direct Labor, and Other Direct Costs allow spreadsheet users to enter additional direct costs that may apply to the crop/year.<ul style="list-style-type: none">○ For purposes of comparison, these costs only matter if there is a difference in these costs between crops, years, or rotations.

Navigating the Spreadsheet:

WORKSHEETS (in order)	EXPLANATION & INSTRUCTIONS
Rotation 1 Rotation 2 Rotation 3 Rotation 4 Rotation 5 Rotation 6 Rotation 7 Rotation 8	<p>(Continued)</p> <ul style="list-style-type: none"> The spreadsheet calculates a legume crop fertilizer credit in the year peas or lentils are grown, when peas are plowed down, and in the last year of an alfalfa stand. The amount of credit is based on the value of the nitrogen fixed. The legume crop fertilizer credit appears in the spreadsheet as a “negative expense” (income). As such, this is a non-cash benefit that is not realized in the year presented, but is attributed to the legume crop. <ul style="list-style-type: none"> If spreadsheet users want this credit to be \$0, the credit amounts (lbs/acre) should be set to zero in the Assumptions Worksheet. The yield, commodity price, direct costs, and return (after direct costs) are shown for each crop/year in the rotation. Direct labor requirements for field operations (hours/acre) for each crop/year. <p>Rotation Summary Calculation:</p> <ul style="list-style-type: none"> Average annual return after direct costs for the rotation.
Rotation Summary	<ul style="list-style-type: none"> Summarizes the average annual returns (after direct costs) for rotations. Lists the crop sequence designed for each rotation. Information presented in crop comparison and rotation comparison charts is gathered from the Rotation Summary worksheet. <ul style="list-style-type: none"> If users want to change chart axis labels, these changes have to be made in the Rotation Summary Worksheet.
Crop Comparison (Chart)	<ul style="list-style-type: none"> Compares return after direct costs in spreadsheets where Rotation 7 is set to compare all crops. Not available on NC_MT_2010_Dryland_Additional_Rotations.xls
Rotation Comparison (Chart)	<ul style="list-style-type: none"> Compares average annual returns of rotations. X-axis labels are abbreviations of rotations pre-entered into the spreadsheet. These labels are set in the Rotation Summary page. <ul style="list-style-type: none"> If crop sequences are changed, the labels on the Rotation Summary page need to be updated.
Rotation Comparison All (Chart)	<ul style="list-style-type: none"> Compares average annual returns of rotations. Labels are set to “Rotation 1” – “Rotation 8”. In the spreadsheets set up to compare crops (Rotation 7 and Rotation 8), Rotation 7 and Rotation 8 are not really rotations.
Rotation Charts (1-4 & 5-8)	<ul style="list-style-type: none"> Provide graphs for each rotation showing the year-to-year return after direct costs. Shows average annual return after direct costs for each rotation

Key Comparisons

- Crop Comparisons: In spreadsheets that compare the economics of different crops, the comparison is the “return after direct costs” per acre. Return after direct costs is a measure that does not include all sources of income or all costs, but instead attempts to narrow and simplify comparisons to relevant differences between crops and rotations.
 - This comparison does not take into account other farm income streams such as government payment revenue, crop insurance revenue, custom farming revenue, or land easement rents and royalties (for conservation, wind energy, or oil and gas production).
 - It is acknowledged that revenue from multiperil crop insurance and government payment programs (such as the ACRE program) may be important considerations in crop and rotation selection that are not taken into account with this decision tool.
 - This comparison also does not take into account fixed costs (such as labor and depreciation), land costs (for which there are no differences between crops or rotations in the case of land that is owned or cash lease land), or certain indirect overhead costs such as repairs or liability insurance that may be difficult to allocate to a particular field or crop. Many of these costs will be incurred regardless of and independent of crop and rotation selection and therefore are not relevant to the comparison.
 - Flexibility exists within the spreadsheet to allow some of these types of costs to be added, if indeed these costs can be accurately allocated or if there will be additional costs identifiable to a particular crop or rotation.
- Rotation Comparisons: Rotations are compared by the following measure: average annual return after direct costs per acre (for the duration of the rotation).

References & Resources:

Agriculture Agri-Food Canada – Pulse Outlook & Oilseeds Outlook

http://www.agr.gc.ca/mad-dam/index_e.php?s1=pubs&s2=spec&page=intro
http://www.agr.gc.ca/pol/mad-dam/index_e.php?s1=pubs&s2=go-co

Agriculture Canada and Agri-Food Canada – Market Analysis Division Publications

http://www.agr.gc.ca/pol/mad-dam/index_e.php?s1=pubs&page=desc

Alberta Weekly Grain Price Report

<http://www.agric.gov.ab.ca/economic/stats/wkgrain.html>
[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/sdd6248](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sdd6248) (archive)

“*Energy Requirements for Various Tillage- Planting Systems*”, and Purdue University Cooperative Extension Service Publication NCR-202-W, July 1983 <http://www.ces.purdue.edu/extmedia/NCR/NCR-202-W.html>

“*Enterprise Crop Budget Generator*”, Montana State University Extension, last modified April 18, 2006 <http://www.montana.edu/softwaredownloads/software/enterprisebudgetor.xls>

“*Estimating Farm Fuel Requirements*”, Colorado State University Extension Farm Management Online Fact Sheets No. 5.006, updated December 20, 2007
<http://www.ext.colostate.edu/PUBS/FARMMGT/05006.html>

FAO’s FAOSTAT database (international production & trade):
<http://faostat.fao.org/site/339/default.aspx>
<http://faostat.fao.org/site/567/default.aspx#ancor>

Government of Saskatchewan - Agriculture Market Trends
<http://www.agriculture.gov.sk.ca/MarketTrends>

Intercontinental Exchange (Canola Futures) <https://www.theice.com/homepage.jhtml>

Montana Wheat & Barley Committee – Montana Current Prices
http://wbc.agr.mt.gov/Producers/pricing_current.html

Montana Wheat & Barley Committee – Montana Historical Prices
http://wbc.agr.mt.gov/Producers/pricing_historical_mt.html

North Dakota State University Extension Service – Farm Management Planning Guides
<http://www.ag.ndsu.edu/pubs/ecguides.html> (2010 & most recent regional Crop Budgets)
<http://www.ag.ndsu.nodak.edu/aginfo/farmmgmt/cropbudget.htm> (archive Crop Budgets)

North Dakota State University, “Pulse Crop Marketing Guide”, August 2006
www.ag.ndsu.edu/pubs/agecon/market/ec1277.pdf

Statpub.com Cash Prices <http://www.statpub.com/stat/cash-mkt.html>

Statpub.com Spot Market Specialty Crop Grower Bids <http://www.statpub.com/stat/prices/spotbid.html>

USDA Agriculture Marketing Service Market News and Transportation Data
<http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateB&navID=MarketNewsAndTransportationData&leftNav=MarketNewsAndTransportationData&page=LSMarketNewsPage>

USDA Agriculture Marketing Service Market News and Transportation Data - State Hay Archives
<http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateW&navID=RN2HayL1&rightNav1=RN2HayL1&topNav=&leftNav=MarketNewsAndTransportationData&page=SearchHayReports&resultType=&acct=lsmn>

Weekly National Bean, Pea & Lentil Market Review
http://www.ams.usda.gov/mnreports/gl_gr851.txt

Dry Edible Bean Daily Grower Bids http://www.ams.usda.gov/mnreports/gl_gr510.txt

Bean Market News [Bean Market News \(Tue\) – pdf](#)

Annual Bean Market News Review [Annual Bean Market News Review - pdf](#)

Kansas City Commodity Invitation of Bids

[Kansas City Commodity – Invitation of Bids - pdf](#)

Kansas City Commodity Awarded Bids [Kansas City Commodity-Awarded Bids - pdf](#)

USDA National Agriculture Statistics Service - Montana County Yield Statistics
http://www.nass.usda.gov/Statistics_by_State/Montana/index.asp (MT County Level Data – Crops)

USDA National Agriculture Statistics Service - Montana Prices Received, Monthly & Marketing Year Averages and Other Economic Data
http://www.nass.usda.gov/Statistics_by_State/Montana/Publications/econtoc.htm

USDA Risk Management Agency – Federal Crop Insurance Corporation
Summary of Business Database <http://www3.rma.usda.gov/apps/sob/stateCountyCrop.cfm>

Alternative Crop Industry Organizations:

Northern Pulse Growers Association	<u>http://www.northernpulse.com/</u>
U.S. Dry Pea & Lentil Council	<u>http://www.pea-lentil.com/</u>
Saskatchewan Pulse Growers	<u>http://www.saskpulse.com/</u>
Alberta Pulse Growers	<u>http://www.pulse.ab.ca/</u>
Pulse Canada	<u>http://www.pulsecanada.com/</u>
Canola Council	<u>http://www.canola-council.org/</u>
Northern Canola Growers Association	<u>http://www.northerncanola.com/</u>
Saskatchewan Mustard Development Commission	<u>http://www.saskmustard.ca/grower/index.html</u>
Flax Council of Canada	<u>http://www.flaxcouncil.ca/english/index.jsp</u>
Ameriflax	<u>http://www.ameriflax.com/</u>

Crop & Crop Rotation References & Resources:

Alfalfa:

“Alfalfa”, August 1998, Kansas Rural Center Sustainable Agriculture Management Guide
<http://www.kansasruralcenter.org/publications/alfalfa.pdf>

“Establishing a Successful Alfalfa Crop”, MontGuide MT 200504 AG, issued May 2005, Montana State University Extension Service
<http://msuextension.org/publications/AgandNaturalResources/MT200504AG.pdf>

“Production of Rain-Fed Alfalfa”, Montana State University Extension Service, 2007
<http://ag.montana.edu/carc/extenpub/07cashproductionrain.pdf>

Camelina:

“Camelina Production in Montana”, Montana State University Extension Service: Montguide MT200701AG, revised March 2008,
<http://msuextension.org/publications/AgandNaturalResources/MT200701Ag.pdf>

Canola:

“Canola Production Field Guide”, North Dakota State University Extension Service, February 2005
www.ag.ndsu.edu/pubs/plantsci/crops/a1280.pdf

North Dakota State University ProCrop Canola Menu <http://www.ag.ndsu.edu/procrop/rps/index.htm>

Chickpeas:

“Growing Chickpea in the Northern Great Plains”, Montana State University Extension Service;
MontGuide MT 200204 AG, issued March 2002
<http://msuextension.org/publications/AgandNaturalResources/MT200204AG.pdf>

“Growing Chickpeas (Garbanzo Beans) in Montana”, Montana State University Integrated Pest Management Center, Last Update: November 16, 2001
<http://ipm.montana.edu/MPIN/Cropfiles/ChickGarb.htm>

Saskatchewan Pulse Production Manual – Chickpea www.saskpulse.com/media/pdfs/ppm-chickpea.pdf

Alberta Agriculture, Food and Rural Development; “Pulse Crops In Alberta”, 1999. (\$35)
order from: [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex17](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex17)

Flax:

“Flaxseed Production in Montana”, Montana State University Integrated Pest Management Center /
USDA Pest Management Centers / NSF Center for Integrated Pest Management
<http://ipm.montana.edu/MPIN/Cropfiles/flaxseed.htm>

“Oilseed Flax: A Montana Specialty Crop”, Montana State University Extension Service, MontGuide MT 8907: <http://cropandsoil.oregonstate.edu/bioenergy/sites/default/files/FlaxOilseed-A-Montana-Specialty-Crop.pdf>

North Dakota State University ProCrop Flax Menu <http://www.ag.ndsu.edu/procrop/flx/index.htm>

Lentils:

“Growing Lentils in Montana”, MontGuide MT 199615 AG, issued June 2001, Montana State University Extension Service <http://msuextension.org/publications/AgandNaturalResources/MT199615AG.pdf>

“Lentil Production in Montana” Last Update: September 13, 2001, Montana State University Integrated Pest Management Center / USDA Pest Management Centers / NSF Center for Integrated Pest Management <http://ipm.montana.edu/MPIN/Cropfiles/Lentil.htm>

North Dakota State University ProCrop Lentil Menu
<http://www.ag.ndsu.edu/procrop/lnt/index.htm>

Saskatchewan Pulse Production Manual – Lentil www.saskpulse.com/media/pdfs/ppm-lentil.pdf

Alberta Agriculture, Food and Rural Development; “Pulse Crops In Alberta”, 1999. (\$35)
order from: [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex17](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex17)

Mustard:

“*Crop Profile for Mustard in Montana*”, Prepared Jan., 2002 Montana State University Integrated Pest Management Center / USDA Pest Management Centers / NSF Center for Integrated Pest Management
<http://www.ipmcenters.org/CropProfiles/docs/MTmustard.html>

“Tame Mustard Production”, Revised June 2007, North Dakota State University, Publication A-935
<http://www.ag.ndsu.edu/pubs/plantsci/crops/a935w.htm>

North Dakota State University ProCrop Mustard Menu
<http://www.ag.ndsu.edu/procrop/mst/index.htm>

“Growing Mustard” Saskatchewan Mustard Development Commission (set of mustard growing and harvesting documents) <http://www.saskmustard.ca/grower/growing/index.html>

“Mustard Production & Management”, Manitoba Agriculture, Food and Rural Initiatives (online mustard production practices information and links)
<http://www.gov.mb.ca/agriculture/crops/specialcrops/big01s01.html#field>

Peas:

“*Crop Profile for Dry Peas in Montana*”, Prepared Feb, 2002 Montana State University Integrated Pest Management Center / USDA Pest Management Centers / NSF Center for Integrated Pest Management,
<http://www.ipmcenters.org/CropProfiles/docs/MTdrypea.html>

“*Growing Dry Pea in Montana*”, MontGuide MT 200502 AG, issued May 2005, Montana State University Extension Service
<http://msuextension.org/publications/AgandNaturalResources/MT200502AG.pdf>
<http://www.montana.edu/wwwpb/pubs/mt200502.html>

North Dakota State University ProCrop Pea Menu <http://www.ag.ndsu.edu/procrop/pea/index.htm>

Saskatchewan Pulse Production Manual – Field Pea www.saskpulse.com/media/pdfs/ppm-field-pea.pdf

Alberta Agriculture, Food and Rural Development; “Pulse Crops In Alberta”, 1999. (\$35)
order from: [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex17](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex17)

Safflower:

“*Safflower Production*” A-870 (Revised), August 2007, North Dakota State University Extension Service
<http://www.ag.ndsu.edu/pubs/plantsci/crops/a870w.htm>

“*Crop Profile for Safflower Production in South Dakota*”, December 2001, South Dakota State University / USDA Pest Management Centers / NSF Center for Integrated Pest Management
<http://www.ipmcenters.org/cropprofiles/docs/SDsafflower.html>

“*Fertilizing Safflower*”, SF-727 (Revised), October 1992, North Dakota State University Extension Service <http://www.ag.ndsu.edu/pubs/plantsci/soilfert/sf727w.htm>

Other Crop Production Resources:

2008 North Dakota Weed Control Guide, W-253, January 2008

<http://www.ag.ndsu.edu/weeds/w253/w253w.htm>

2010 North Dakota Weed Control Guide

http://www.ndsu.edu/weeds/weed_control_guides/2010_weed_control_guide/

2010 North Dakota Fungicide Control Guide <http://www.ag.ndsu.edu/extplantpath/fungicide.html>

North Dakota Field Crop Insect Management Guide, December 2009

<http://www.ag.ndsu.edu/pubs/plantsci/pests/e1143w1.htm>

http://www.ag.ndsu.nodak.edu/aginfo/entomology/entupdates/ICG_10/ICGall_10.pdf

“*Crop Rotations for Increased Productivity*” EB-48 (Revised), January 1998, North Dakota State University Extension Service

<http://www.ag.ndsu.edu/pubs/plantsci/crops/eb48-1.htm>

“*Fertilizer Guidelines for Montana Crops*”, Publication # EB 161, March 2005, Montana State University Extension Service <http://msuextension.org/publications/AgandNaturalResources/EB0161.pdf>

Montana State University Extension Service - Fertilizer Economics webpage

<http://landresources.montana.edu/soilfertility/fertilizereconomics.htm>

“*Integrated Strategies for Managing Agricultural Weeds*”, Montguide MT 200601 AG, July 2006, Montana State University Extension Service

<http://msuextension.org/publications/AgandNaturalResources/MT200601AG.pdf>

“*Nitrogen Credits from Sod*”, Cornell University

http://nmsp.css.cornell.edu/publications/tables/pdf/N_credits_sods.pdf

North Dakota Crop Sequence Calculator, USDA Agriculture Research Service – Mandan

<http://www.ars.usda.gov/Services/docs.htm?docid=10791>